Menlo Park Notebook #14 [N-78-12-31]

This notebook covers the period December 1878-February 1879. Most of the entries are by Edison, Charles Batchelor, and Francis Upton. A few entries are by Charles P. Edison and John Kruesi. Many entries are signed by Edison. Almost all of the material relates to experiments on electric lighting. There are notes and calculations about lamp and filament tests, including a numbered series cross-referenced to other notebooks; and notes, drawings, and calculations about generators, some similarly cross-referenced. There are also notes and drawings of the new receiver for the telephone. The book contains 288 numbered pages.

Blank pages not filmed: 4-5, 236-237, 280-285.

14

Full

From the Laboratory
of
T. A. EDISON.
MENLO PARK, N. J.

No. 14

Magnet armature 1st machine p. 3
Welding arrangements Mr Stephens
Tests of Spirals with varying
sizes of cells. Jan 77. p. 30-95
Tests of spirals in vacuum
and various materials for
insulating with experiments.
Important and interesting. Feb. p. 97-163
Winding of ~~Dynamo~~ from the machine
p. 168-257

N-78 12·31

N-78-12-31

No 14

27.6532

58.9792

~~2655.04~~ 73.2

~~2655.04~~ ~~2655~~ 17.75

3.685 ~~4570~~ 73/4

LIBRARY OF THE

BOARD OF PATENT CONTROL,

120 BROADWAY, NEW YORK.

No 14 1

4 3.1 12

4" 1/2 3.14 36

36
36
1 73 18
7 3 17.2 69 18
17 70 18
73

3.14
12.56
3.14
9.42

3

1 turn = 73 inches 36 lines

2 turns = 73 " 17.75 lines

4 turns = 73 = 8 layers 8.625 lines

8 turns = 16 layers 4.06 lines

16 turns 32 layers 1.78

No 14

No 14

Pages 1 to 2. "Dynamo Notes." (Unimportant)

73 inches.

36 Cent

75 Cent

625 Cent

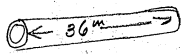
16 | 942 | 59
80
142
59 wires
16
144
4130
4307
359 | 11096
925

16
94
144
152
16
2656
1064

Chas Batchelor Dec 1878 3

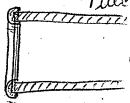
New Magneto Machine

Armature



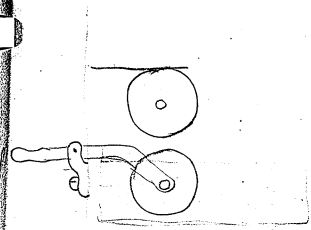
Bramete outside 3-2
inside 3-

This armature has ends of Vulcanized fibre bounded off so as not to hit the wire



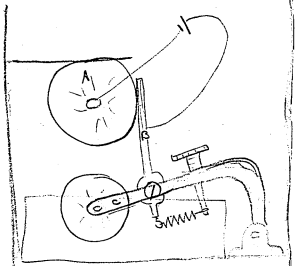
and one wire wound round it lengthwise and one end polished off so as to be used as a commutator.

New Invention Oct 31st 1878
Chas. P. Edison



New Rainer Dec 31st 1878

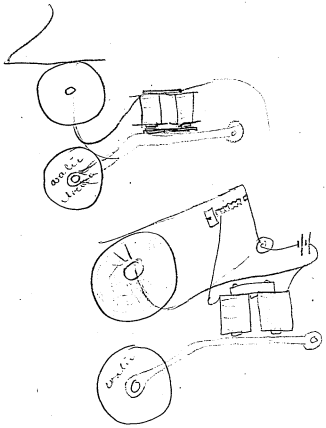
Chas. L. Edison



friction feed.

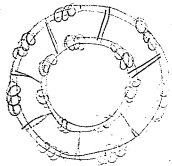
when button (A) is dry there is greater friction which draws up lever (B) which elevates slide (C) with moist roller

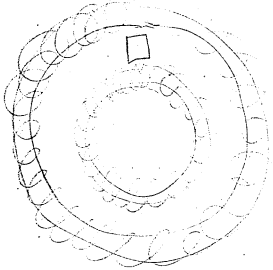
New receiver Dec 31st 1876 11
Thos. A. Edison

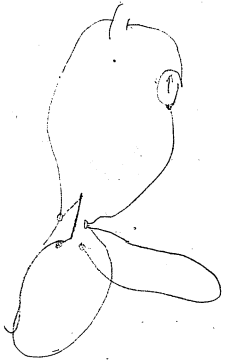


New Leaves Dec 31st 1878

Dec 31 1878







$R + B : B :: D : D_1$

Dec 31 1878

$\cancel{R + B = \frac{B D}{D_1}}$

$$R D_1 + B D_1 = B D$$

$$B = \frac{R D_1}{D - D_1}$$

$G + B + R : G + B + R_1 :: D_1 : D$

$$(G + B) D + R D = (G + B) D_1 + R_1 D_1$$

$$G + B = \frac{R_1 D_1 - R D}{D - D_1}$$

2

11

$$R = \frac{1}{R_1} + \frac{1}{R_2} = \frac{R_1 + R_2}{R_1 R_2}$$

$$C = \frac{\varepsilon}{R} \qquad C = \frac{\varepsilon}{\frac{R_1 + R_2}{R_1 R_2}}$$

$$= \frac{\varepsilon R_1 R_2}{R_1 + R_2}$$

$C_{total} = C_{1} + (total) : R_2$

19

$B + R + \mathcal{G}$

Dec 31 1978

$R + R_1 + \mathcal{G}$ $\quad \mathcal{D}$

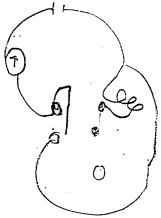
$$B + \frac{R_1 + R_2}{R_1 R_2}$$

$R_1 = \mathcal{F}$

$R_2 = \mathcal{F} + R_3$

$$B + \frac{\mathcal{D} + \mathcal{G} + R_3}{\mathcal{F}(\mathcal{G} + R_3)}$$

$\mathcal{D}_{\neq}$



20

Current in one arm

Current total = 1

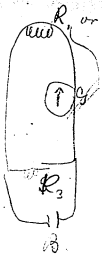
$C_1 : C_2 :: R_2 : R_1$

$C_{total} : C_2 :: R_2 : R_{total}$

$C_1 : C_2 :: \frac{1}{R_1} : \frac{1}{R_2}$

$$\frac{C_1}{C_2} = \frac{\frac{1}{R_1}}{\frac{1}{R_2}} = \frac{R_2}{R_1}$$

Dec 31 1898 23



$$C = \frac{\mathcal{E}}{B + \mathcal{G} + R_1} = D$$

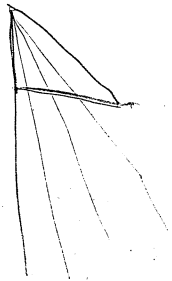
$C = ?$

$$C_{total} = \frac{\mathcal{E}}{\frac{R_2 + R_3}{R_2 R_3} + B} = \frac{\mathcal{E} R_2 R_3}{R_2 + R_3 + BR_2R_3}$$

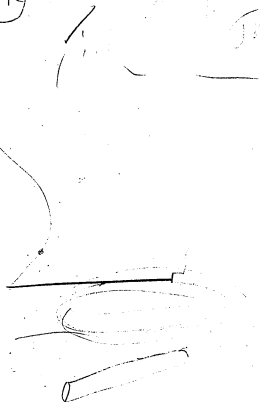
$$C \frac{R_2 R_3}{R_2 + R_3} = \frac{\mathcal{E} R_2 R_3}{R_2 + R_3 + BR_2R_3}$$

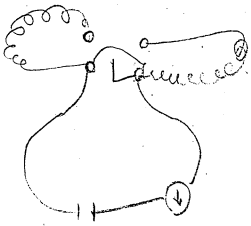
$$C = \frac{\mathcal{E}(R_2 + R_3)}{R}$$

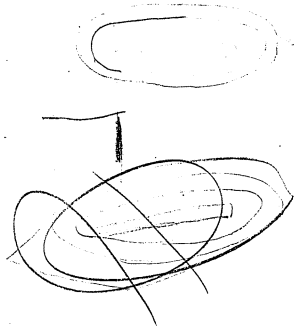
5 $\frac{9}{16}$

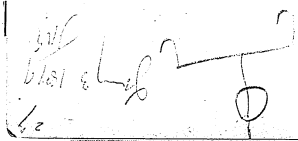


7

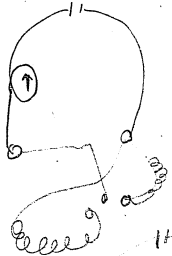


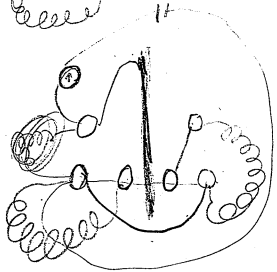






Jany 3rd 1879





1. 30
150 cm. ~~No~~ .004 wire
Iridium Pt alloy 20%
Spool No ~~#~~ 1
The wire stretched between the two small wires

~~6.39~~

Cold 6.39 Ohms

Called. 7°,15' on the strip
without a shunt

2. Pt. Ird. the same as
No. 1. D = 4° .0342
R = 6.39
One cell carbon
same resistance cold
deflection 4° on strip
Called with shunt of .0342 ohms

3. Pt. Ird same No. 1
2 cells Carbon
7.8 Ohms
6° deflection with
shunt as in No 2
.0860
2.19 times.

324 Same No 1

3 cells carbon

Broadley with shunt as in No. 2

8.1 Ohms

8°

9.147
9.147
.908
19.202

log 0.159 $\bar{1}.202$ ~~0.0~~
$\bar{2}.593$ .159
4.06 .609

Same as No. 4. Given 3rd Sept 33

4 cells carbon

8.8 Ohms

10° deflection Mr B. thinks that this is just on the road very faint ~~[illegible]~~ "faintest glimmer".

9.246
9.246
.940
19.436

log. 0.273 $\bar{1}.436$
$\bar{2}.592$
.843 6.97

34

6 same as No 5

5 cells

~~Bright~~ red No. 1

9.8 Ohms

D = 11°

9.288
9.288
.991
19 567
log 0.369 $\bar{1}$.567
$\bar{2}$ 593
.974 9.42

$\bar{1}$.567
$\bar{1}$.436
.131 1.35
~~2.04~~

35

same as 6

6 cells

Bright red in diffused daylight, while covered

10.2 Ohms

D = 12° 30'

~~9.235~~
~~9.275~~
9.345
9.345
1.008
19 698

log 0.499 $\bar{1}$.698
$\bar{2}$.593
12.7 1.105

$\bar{1}$.698
$\bar{1}$.436
1.85 .262

1.698
1.567
1.35 .131

$\bar{1}$.698
$\bar{1}$.436
.262

same no 7

7 cells

Yellow red or orange
look like $\frac{1}{32}$ in diameter
distance 2 ft.

D = 13° 30'

R = ~~11.5~~ Ohms
11.1 Ohms

9.380
9.380
1.045
19.805

log .639 $\bar{1}.805$
$\bar{2}.593$
1.212 16.2

$\bar{1}.805$
$\bar{1}.436$
.369 2.34

.238 1.73

same No 8

8 cells

Yellow and beginning to
light. "Small amount of
light" looks at distance
of two feet to be $\frac{1}{16}$ of inch
thick. Lags 3/8 in.

D = 14° 30'

R = 11.1

9.412
9.412
1.045
19.869

log 0.740 $\bar{1}.869$
$\bar{2}.593$
1.276 18.9

.433 2.71

.302 2.0

10 38

9 cells

Quite white.

Appears a shade more than 1/10 at 2 feet

D = 15°

R = 12.2

9.428
9.428
1.086
.875 7.942

1.349 22.3

.506 3.21

.375 2.38

May 3rd 1919 39

10 cells

a good bright light, wire appeared to radiate a little, appeared no larger

D = 16°

R = 12.6

9.457
9.457
1.100
20.014

by ~~.875~~ 0.014
1.030 1.421 26.5

.578 3.79

.447 2.8

9.2 40

11 cells

with a tinge of yellow

White light the cone seemed ~~[illegible]~~ covered with fine lines

D = 17° 30'

R = 12.96

9.498
9.498
1.110

log 1.28 .106
2.593 — 32.7
1.513
1.428
.670 — 4.68

.106
1.567 — 3.48
.539

12 cells

Jimmy 3' 29 41 13

~~Brilliant~~ Full white

D = ~~15~~ 18° 30'

R = 13.26

9.524
9.524
1.122

1.47 .168
2.593 — 37.8
1.575

168
1.436 — 5.4
.732

168
1.567 — 3.98
.601

~~12~~

13 cells

Brilliant white

D = 19° 30'

R = 13.56

9.549
9.549
1.132

1.70 — .230
2.593
Cold — 7.637 — 43.4

— .230
1.436
.794 — 6.22

— .230
1.567
.663 — 4.61

14 cells

Intense white as far as wished

236
— 2.893
~~7.643~~

D = 19° 30' 7.643 — 44.

R = 13.86

9.549
9.549
1.138

1.72 — .236
Just Red — 1.436
log 6.31 — .800

Red — .236
— 1.567
log 4.67 = .669

No. 2 $D = 4°$

$R = 6.39$

C° R.

8.[illegible]

[illegible]

.805

18.593

2.593 .0392

No. 3 $D = 6°$

$R = 7.8$

9.021

9.021

.592

18.934 .0860

2.934

2.593

.341 2.19

January 3rd 1879 [illegible]

When a 150 MM. [illegible] of 2000 millimetres [illegible] is brought to measurement at permanent elongation, 1/2 a MM. due probably [illegible] being obtained by [illegible]

If when measurements [illegible] the only [illegible] thought of [illegible] elongation [illegible] as [illegible] not [illegible] fine –

Measurement – [illegible] is [illegible] to be [illegible] light & will after a moment [illegible] quiet commence [illegible] a tuned [illegible] vibration of 1/8 of an inch apparent, when it ceases by this effort [illegible]

The effect of this vibration is [illegible] to cool the inner producing contraction, a blue light appears in the centre of the [illegible]

of vibration. January 3 1879

1) The wire is bent 2 inch 2 inch - 7 inch
& the Current put on & off
with a rapid movement - the 2 inch
2 inch jump apart & an audible
Click is perfectly reproduced.

At a distance of 15 feet the
incandescent wire looks to be
3/16 of an inch diameter

16 46/4 cells Carbon makes 5 30 ohm
.004 just faint red. stitches
in the open air.

D = 10° 30′ with shunt
R = 30.86 ohms

The same as 16 with Calloid 47/17
cold.

Jany 31 1874
J.P.

R = 20.46
D = 22° 30′ on no 3. wire

1.810 .004 Pt. Iridium 150 Mm

Rhol = 2

1 colloid Cold R = 6 ohms

19 1 cell Carbon

D = 4.

~~R = 6 ohms~~

R = 6.1

8.844
8.844
.826
18.514

8.844
8.844
.784
18.476
2.476

0.030

2 cells

2 05-7

D = ~~0.1~~ 6°.45-1 9.000
~~9.000~~

R = 6.7

9.073
9.073
.826
18.972
2.972
2.476
.496

0.0938

3.1

2 1/2 3 cells

D = 9° 30' 9.223
R = 7.3 ohms 9.223
.863
19.309
0.204 1.309
2.476
8.6 .933

4 cells slightly red -22-D

D = 11° 9.288
R = 7.9 9.288
.597
0.297 19.473
1.473
2.476
9.9 .997

January 5 1899

JR

2354

5 cells dull red

$\bar{D} = 13^{\circ}$

$R = 8.5$

	9.363
	9.362
	929
	19.655
0.452	1.655
15.1	1.179
1.53	.182

6 cells red orange

$\bar{D} = 14^{\circ}$

~~$R = 8.9$ ohms~~

$R = 8.731$

	9.396
	9.396
	~~929~~
	.247
	19.733
0.541	1.733
18.1	1.257
1.82	
	.260
1.19	
	.078

D-24

2.5 56

7 cells Orange yellow

a slight red may be seen by squinting the eyes

D = 1.50

R = 9.2

9.428
9.428
.963
19.819
$\bar{1}$.819
$\bar{2}$.476 22.2
0.660 1.343

$\bar{1}$.473
.346 22.3

$\bar{1}$.655 1.64
.164

8 cells Yellow

squinting little orange

D = 16

R = 9.16 Ohm

9.457
9.457
.982
19.896
.788 $\bar{1}$.896

$\bar{1}$.896
$\bar{2}$.476 26.3
$\bar{1}$.420

$\bar{1}$.896
$\bar{1}$.473 2.64
.423

$\bar{1}$.896
$\bar{1}$.655 1.74
.241

9 cells bright yellow
whitish yellow

$\delta = 17^\circ 30'$ 9.498
$R = 10$ 9.498
1.

19 996
$\bar{1}.996$

0.991

$\bar{1}.996$
$\bar{2}.476$ 33.1
1.520

$\bar{1}.996$
$\bar{1}.473$ 3.31
523

$\bar{1}.996$
$\bar{1}.655$ 2.21
344

10 cells dull white
yellowish white
white yellow

$D = 17^\circ 30'$ 9.498
$R = 10.3$ Lines 9.498
1.012
20 008

1.02
.008
$\bar{2}.476$ 34.1
1.532

.008
$\bar{1}.473$ 3.43
.535

.008
1.655 2.26
.353

~~29.60~~

11 cells ~~Wh~~ The same as candle 8 1/2

D = 19. I, one mmed yellow

R = 10.5

9.536
9.536
1.021
20.093

1.24 .093

.093
2.476
1.617 41.4

.093
1.473
.620 4.17

.093
1.655
.438 2.74

12. a little yellower than candle 9, whiter than candle 8 ~~9~~ 13.30

D = 19° 30'

R = 10.7

9.549
9.549
1.079
29.127
30.
0.127

~~0.130~~
1.34

.127
2.479
1.648 44.5

.127
1.473
.654 4.53

.127
1.655
.472 2.97

31/3 cells

a little yellower than candle 4 ft distance

Bright White S 14 R

D = 20' 30'

R = 11 8 ft

9.572
9.572
11041
20.185

1.53

.185
2.476
1.709

51.2

.185
1.473
.712

5.16

.185
1.655
.530

3.39

14 cells

Brilliant White S 13 R

The same as candle 4 ft distance

placed side by side and it seemed whiter and 8 times as big by inverse Table

D = 210

R = ~~11.5~~

11.5

Wire melted at 140 min in length.

9.584
9.584
1.060
20.228

.228
1.473 m.22
.755 day
5.69 times

.228
2.476
1.752

1.691

56.5

.228
1.655 m.23
.573

3.75 times

64 See sheet no 3

Pt wire .004 150 mm

1 Cell D = 5°

R = 4 ohms

	8.9.419
	8.9.419
	.6020
6.306	8.4858
	2.4858

2 cells D = 8° 30'

R = 4.9

	9.1744
	9.1744
	6902
	17.0370
0.12	$\bar{1}$.0296
	$\bar{2}$.4858
3.56	$\bar{E}$.5532

3 cells D = 11°

R = 5.7

	9.2486
	9.2486
	7558
	7.2330
.215	$\bar{1}$.3320
	$\bar{2}$.4858
7.03	$\bar{E}$.8472

4 cells D = 13° ~~Dull red~~

R = 6'.5

Dull red better than first color on No. 1 Dr. Sheets

	9.3633
	9.3633
	.8129
.3461	19.5395
	$\bar{1}$.5395
	$\bar{2}$.4858
11.3	1.0537

5 cells Red

D = 14°

R = 7.2

	9.3167
	9.3167
	.8129
	19.8567
.447	$\bar{1}$.5567
	$\bar{2}$.4858
1416	1.1649
	$\bar{1}$.6567
	$\bar{1}$.5395
1.29	.1172

Jany 5 1879

P.S.

6 cells Yellowish orange

$\theta = 15^\circ 30'$

$R = 7.9$

	9.4429
	9.4429
	8976
8.607	1.917834
	$\bar{1}.7834$
	2.4858
19.8	1.2976
	$\bar{1}.7834$
	$\bar{1}.5392$
1.65	.2439
	$\bar{1}.7834$
	$\bar{1}.6507$
1.35	.1327

7 cells Yellow

$\theta = 15^\circ 30'$

$R = 8.3$

	[illegible]
	[illegible]
	[illegible]
0.638	[illegible]
	$\bar{1}.[illegible]$
	2.4[illegible]
20.8	1.3[illegible]
	$\bar{1}$ [illegible]
	[illegible]
1.84	.2653
	$\bar{1}$ [illegible]
	$\bar{1}.6507$
1.42	.1527

Jany 5 1884

8 cells Light bright Yellow

D = 17° 20′ 9.4787
R = 8.70 9.4787
.9415
$\bar{1}$.9389

.869 $\bar{1}$.9389
28.3 $\bar{2}$.4858
$\bar{1}$.4531

$\bar{1}$.9389
2.51 ~~3.76~~ $\bar{1}$.3995
.3994

$\bar{1}$.9389
1.94 $\bar{1}$.6557
.2832

9 cells Whitish Yellow

D = 18° 30′ 9.5245
R = 9. 9.9542
.9561
$\bar{2}$.0561

1,101 $\bar{0}$.0561
33.1 $\bar{2}$.4958
$\bar{1}$.5198

.0561
2.92 $\bar{1}$.5395
.4656

.0561
2.26 $\bar{1}$.5507
.3544

Jany 5 1879.
TAE

72

10 cell Yellowish White

D = 19° 2 01 — 9.5491

R = 9.[illegible] — 9.5491

.9637

24.0619

1.15 — .0619

2.4858

37.7 — 1.5761

.0619

7.5295

3.33 — .5224

.0619

7.6507

2.58 — .4112

71

11 cells White

[illegible] 20° 30 — 9.5727

9.5727

.0777

29.1231

1.328 — .1231

2.4858

43.4 — 1.6373

.1231

7.5395

3.83 — .5832

.1231

7.6507

2.97 — .4724

[illegible]

72 cells Brought White

D = 21°

R = 9.9

	9.55841
	9.28441
	.9956
1.452	2016 38
	.1638
	2.45558
47.3	1.6780
	.1638
	1.53295
4.22	.6243
	.1638
	1.65397
3.26	.5131

13 Brilliant white 75

D = 21° 30

R = 10.5

	9.55855
	9.595
	1.021
1.653	2.2217
	.2217
	3.45558
54.4	1.7359
	.2217
	1.53295
4.81	.6822
	.2217
	1.0207
3.72	.5710

Jany 8. 1895

14 Cells omitted

150

4 in = 100

6 in

.314
.004
.01256
.00756
.075336
.075336

.314
.004
.01256
.00756
.075336

.075) 1.000 (15
75
150

Jonny's [illegible]
Tax

78 Iron lamps red 6 cells

D = ~~[illegible]~~ = 19°

R = .5 ohms hot

Cold 1.2 ohms

9.5369 . The same ohms

9.5369 as on Jan 14.

.6959

19.7727

7.7727

.592

.2217

No. 3 . 7.7727

.4490

White ~~Tungsten~~ wire No. 3. ~~[illegible]~~ gave

~~[illegible]~~ 2.8 more heat than red

Fe. lamp with 1 in. surface

Jan 15.

Question how many lamps can be made to give 15 candles when wire gauge

Three Iron lamps

all the cells of battery = 14

65° on No. 3 11.6 Ohms

3 Fe. lamps

D = 19° with shunt

2 Fe. lamps, ~~[illegible]~~

D = 21°

R = 11. .02

14

.6

16.8

50

8.9419
8.9419
6.1 0.7853
~~19.66~~91
~~1.66~~91
18.6691
2.6691

.46

60

9.0216
9.0216
1.7853
19.8285
.67 1.8285

46) 346 (7.
322
240

67) 346 (5
335
11

2 Ohm + B

16° = D + 1° = 17°

8° 30' + 1 = 9° 30'

82

2 cells

$$C = \frac{\mathcal{E}}{R + B}$$

$$C_1 = \frac{\mathcal{E}}{R_1 + B}$$

$$C(R + B) = C_1(R_1 + R)$$

$$\frac{C_1 R_1 - C R}{C - C_1} = B$$

$17 = C$

$9.5 = C_1$

$2 = R$

$4 = R_1$

$$\begin{array}{r} 9.5 \\ 11 \\ \hline 38.0 \end{array} \qquad \begin{array}{r} 17 \\ 2 \\ \hline 2.4 \end{array}$$

$17 - 9.5 = 7.5$

$$7.5 \overline{)4.00} \quad \begin{array}{r} .53 \\ 225 \\ \hline 175 \end{array}$$

$$\frac{38 - 2.4}{7.5} = \frac{4}{7.5} = .53$$

$.22$ Ohm $= R$

1 Cell C & 2 Ohms in 42.5° = .932

C, R, 4 Ohms in 26° = .487

$$\begin{array}{r} .487 \\ 4 \\ \hline 1.948 \\ 1.364 \\ \hline .584 \end{array} \qquad \begin{array}{r} .932 \\ 3 \\ \hline 2.794 \end{array} \qquad \begin{array}{r} .922 \\ .487 \\ \hline .445 \end{array}$$

No R

82°

.4 70°

$$\begin{array}{r} 990 \\ .4 \\ \hline 396.0 \end{array}$$

$$C = \frac{E}{B}$$

$$C_1 = \frac{E}{B+R}$$

$$CB = C_1B + C_1R$$

$$B = \frac{C_1 R}{C - C_1}$$

tan 82° .990

tan 70° .939

.051

.987

.396

Platinum Wire .004

150 m m

14 ells Dull Red $6\frac{1}{4}^\circ$

Resistance 28 ohms

Defect in Good as

it bent the strap

Shaft bent down
Deflection 12°

Deflect 12

Jany 2 1844

$W = \mathcal{E} Q \qquad \mathcal{E} = C R$

$Q = C t$

$W = C^2 R t = H$

$H = C^2 (\rho + r + l)$

$C = \dfrac{\mathcal{E}}{\rho + r + l}$

$H = \dfrac{\mathcal{E}^2}{\rho + r + l}$

From lamps in multiple arc

each 22' defective

estimated to have [illegible] for

20 Ohms in 4

5 Ohms in 1

---

4 ⊃ in B and [illegible]

in multiple

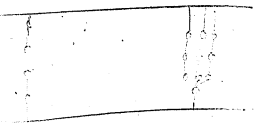
4 ⊃ 0

[illegible]

90

1.243

8-51 P.M



75
2

150	0.176091
205	0.371454
205	0.371454
	.919997

524

3 lamps in multiple?
no battery and leads

D = 510 1.27

Rh lamps

D = 640 2.05

60 Jan 12

1.27 2.05

5 = 1.66 0.220104
1.27 0.110 3404
1.27 0.110 3404
.4 27522

267

92

$\frac{1}{1.27}$

2

2500

1 Ohm at 6.2°

2438

256

256) 2438 (9.5
2304
1346
1.6
3
4.8

1.27 2.05

1.27) 2.05 (1.6
1.27
780
762
18

$C = \frac{E}{R}$

$1.27 = \frac{E}{1.57}$ $1.57 = \frac{E}{1.27}$

$C = \frac{E}{1.57}$ Gan

$\frac{1}{1.57}$ $\frac{1}{1.27}$

1.27 1.57

1.27 1.57

$\frac{1.57 \times 1.57}{1.27 \times 1.27}$

$1.27 = \frac{1}{R^2}$ $1.57 = \frac{1}{R}$

$R = \frac{1}{1.27}$ $R = \frac{1}{1.57}$

1.27 1.57

5)50
10 5 per H.P.

.10002

1.1240

3.6
2
7.2

72)1.12400(1.560
72
404
360
440
432
680

1.1240

7.2

Jany 12 1877

24.200.
5600

Feby 6 7 8 9 9th 1879

Experiments with wires in a Vacuum -

Platinum Iridium alloy 20 pc Ir =

Our mechanical pump with $\frac{1}{100}$ of an

inch vacuum = Pt-Ir wire loses about

$\frac{1}{10}$ of a milligramme per hour, which

is deposited upon the glass - the surface

in which this loss occurs is about

1/4 of an inch. Resistance .75 of an Ohm

Cold size wire .020 of an inch

If the platinum wire is brought to a

dull red and the vacuum made

1/10 of an inch & allowed to remain

red for 1 minute & then made

yellow and the vacuum made perfect again then wire brought gradually up making vacuum perfect after each increment of heat the wire may be brought to 21 candle power (10) 1/4 of inch radiating surface will give 21 C.P. the wire grows exceedingly bright, resembling polished silver and under the microscope shows no cracks, whereas if brought to incandescence suddenly it shows great cracks: I think

from our experiments that the melting point is determined greatly by the amount of gas within the pores of the metal which by its expansion disrupts the metal and makes it fuse sooner. By gradually increasing the heat the gas gradually comes out of the metal without disrupting or cracking it. Roughly speaking I think that if the melting point of platina in the air by sudden heat bringing to incandescence

is 2000 °C then its melting point is raised to at least 5000 °C by subjecting it to the process of [illegible] it was by heat in a vacuum 3 inch Carbon [illegible] that we can on an engine of [illegible] for $\frac{1}{4}$ inch in open air to think all metals to which held go in their power or even other metals or metalloids have a lower melting point because the inequal Expansion disrupt the

metals & crack it thus 105
allowing it to fall on
Easy pressure to the bottom

Feby 10 1849

Experiments with Steel
Pianoforte wire in vacuum
about .020 wire - $\frac{1}{4}$ inch
radiating surface

We cooled one with chalk
water & dried platinum in
Vacuum. Some of the chemicals
were brought to ~~white~~
impure white heat -
there was large amount

at Pallion and that was
from one turn to other —
cross connected; the composition
of the chalk making gases, arsenic
and probably prevented the
oxidation = we have not found
previously that pyrite was
may be brought [illegible]
to pure cobalt [illegible]
but the oxide formed has a
much lower melting point
than the steel therefore
Rodd. [illegible] exclude all the
gases & have a 1,000,000 of

an atmosphere vacuum
& the iron was [illegible]
[illegible] bring it [illegible] the
most dazzling [illegible]
[illegible]
[illegible] nothing & I do not think
[illegible] [illegible]

We now put in a spiral
with lime in N_2O & dried
very little oxide formed but it
melted ~~slightly~~ coming up in
before the spiral = the lime
does not stick well but

Cakes off = I notice when it
melted & flowed where lime was
on it. Beautiful scales of
Violet & gold Color probably
a Compound of Ammonia & lime

We now put in a plain steel
spoon & concentrated [illegible]
out so turns [illegible] came
in Contact – & we [illegible]
to raise the heat [illegible]
in 2 minutes [illegible]
a full white in a [illegible]
for higher it melts [illegible]
parts summed [illegible]

we now put in another steel spiral
with its convolutions further apart
to prevent a great variation in heat
at parts of the spiral = brought
it to clean white, when it melted
in one spot showing a flaw there
stained knives ground in all
parts before melting had there
been no flaw -

Discovery

tried another power brought
it up very gradually it was
coated with black or blue
oxide with 2 coils
when it melted it went in
all parts at once

when change to say the
oxide valablyed in the glass
& left the whole of the
spiral which was incandescent
as bright as Silver.
I found that this brightness
wire was entirely decarbonized
& could not be hardened whereas
a part which was only dull
red was hardened by water
until it was as brittle as
glass —
We put asbest wire in
atmosphere of Hydrogen.

it required a very much greater
current to raise it to incandescence
and it melted at a much
whiter heat showing apparently
that the Hydrogen had more
influence on the [illegible]
than upon the [illegible]
means of [illegible]
point as the [illegible]
a vacuum yet the [illegible]
trace the light.

Perhaps there is [illegible]
quantity of [illegible]
in the atmosphere which
~~[illegible]~~ fills the space

of the hypothetical ether -
& thus accounting for the
diminished intensity of
the platinum in air as against
the vacuum, of course taking
into consideration the
gain due to crossing of
connection currents -

Put in new spiral brought
to yellow white at 4.35
PM on gramme machine -
added current 4.50 brought
to incandescence fused 4.52

Magnesium wire was brought to a dull red by an melting in a vacuum hence the melting point as given in the books (1) 447. Fahr or 230 C must be wrong or Draper's wrong in attributing 900 to a dull red =

We now put a wrought iron spiral in and bring it to yellow white and by letting it gradually fall to dull red in 25 minutes

owing to palpitation of the
battery - Martin go to supper &
take battery off at 655. We
keeping up vacuum -
We brought it at 720. to
a dozzling white by Jammie
but in 1 minute it melted
because we tried to bring
it too high.

Feb. 10

Iron wire .020 in. in diam
wound in the coils
separated .060 in. The ~~heating~~
current was put on gradually
and an arcide noticed before
red heat was reached. Taken out
and polished to see if the oxydation
could have arisen from the O in the iron
again tho'ly oxydized.

"The color of the flame
when the iron melted was
a strong violet" E
Flue B. Fluint violet R.
It was white and scintillated
some moments before melting.
The Gramme machine was
used.

179

The wire when taken off after furnace was found to have a very high polish

No. 2 Iron W Feb 10 '99 (TAE)

.020 in in diam

6 1/16 in length 12 turns

.060 separated on a mandrel

Filled with H pumps and all ~~HHHHHH~~ 10 times

Immediately with less than 2 in vacuum the battery was put on. The wire became black. The Gramme machine used Violet Martin. Ultra violet Edison. Light blue & lighter than the blue of sulphur B. Blue of sulphur N. or light blue

Ex. To try iron wire in H and have it coated with lime to see if the presence of H has any effect. There seems to be in the O-H blow pipe another effect than simple heat in producing the intense light found.

The wire wound close and the spaces between the coils filled with lime. In air of H at Atmos. pressure with the Gramme machine and strong current the spirals only red. And even when brought to fusion

By the other Day Mr. E. tried a lt. wire as an induction spark a ~~coil~~ coil on button, on the secondary. The light was quite brilliant from a very small spark. This shows the fineness of the division.

no signs of the whiteness seen on the D H blow pipe.

Ex. No. 4 Feb 10 Pm. Feb 13 1877 JAS

A spiral covered with titanic acid made into paste by with alcohol.

The titanium oxide mixed with the wire and ~~[illegible]~~ shot [illegible] to a great extent ~~the~~ [illegible]. The wire melted very [illegible] tanic. Peculiar smells are received when taken off. The wire very much harder. After heating and plunging in water becomes very hard but not extremely brittle.

Ex. No. 5. The wire passed through the fingers when bent at right angles and could be felt to break into short sections.

July 10 1879 JAE

Ex. No. 6.

Very fine wire.

It was very bright and seemed to melt all of a mass. There was no scintillations.

Ex. No. 7.

Wire ~~the~~ .014 in. Very brilliant sank slowly without breaking. No scintillations.

No. 7 Feb 12 1879 Tue

Crucible Wharton's chemically pure nickel. Forged heated ~~red hot~~ by H. red hot. Rolled out hot until two inches long. Then cold until about fifteen inches, and .001 in thickness and 1/8 in. in width. Pieces were put as near as possible to each other and the N formed many times between them

Ex. No. 6. 3/16 wide

.001 15 in. ~~short~~ of N cannot be melted in Bunsen and with blowpipe. Faint signs of fusion probably of the Ex. No. 9 wire when made 1/8 wide.

Steel wire easily melted in same flame as No. 6

Ex. No. 10. Smaller wire than No. 9 easily melts.

Ex. No. 10. Pt foil same thickness as N in No. 5 in same flame at

Feby 12 1879 T.P.

Ex. No. 11 N & Pt [illegible] the same flame [illegible] and very little difference noted in their behaviour. Pt melted slightly and a slight [illegible] on the N.

Ex. No. 12 Iron wire rolled into thin sheet and held in Bunsen did not melt

Ex. No. 13 Held in blow pipe flame of Mr. Bunsen. Died

not melt but ~~and~~ ~~melt~~ became very brittle and probably changed with black oxide. Feby 12 1897 T.A.

Ex. No. 14. The N. foil burned in a spiral on a mandril. Breaks very easily at any turn across the foil. A spiral tried in a vacuum. 1/4 in Did not blacken as iron before becoming red. Could be brought to incandescence. Fused with yellow light. Slight violet B. Wire appeared like clay afterwards. Feb 11 P.M.

Ex. No. 15. A piece of nitronickel tried in same flame as No 10. Did not melt even on the corners. Forms a bright oxide.

Feb. 12 1878
Mr. B. tried a globe and found glass too thin
Directions for Cl Book 47 to
Pp 157-159

Feb 11 P.M.
Ex. No. 16 She came as no. 15 with small spine two or three inches when it fences. Defined number to be blue.
Feb 12 1877 TH

The following forms of apparatus was used to introduce them wire in the vagina
See Books 9 Page 153
Page 117 Book 13
Book 4 Pp 61 152, 53
for proposed form 54, 67

Four forms proposed for Sucker Tube to exhaust air
Book 13 Page 114 & 121
drawn by Mr. E —

142

Recommendation of

Feb. 12, 1878.

Coating Pt with oxides by decomposition of the Nitrate by means of heat.

Ex No. 17 Nitrate of zirconium does not coat the wire at bright red nor at dull red heat. Red at little for in it

Ex. No. 18 Zircon apparently contains Marcket's Zr. very impure. melts instantly.

Ex No. 19 Nitrate Calcium coats the wire without apparently dulling it. ~~The~~ Under microscope coated all over but in globules and

penny thin between the [illegible] finger tips very impure. A spot could be found which the coating did not cover. Does not even [illegible] wiping much. Was rubbed [illegible] fingers [illegible] the coating [illegible] hands. At penny [illegible] good coating [illegible] could be obtained [illegible] through the coating.

The idea is to [illegible] and [illegible] to use of [illegible] The [illegible] of [illegible] Tried the solution.

Had the wire [illegible] current [illegible] lamp. Rubbed and then [illegible] perfect coating obtained and the [illegible] must be [illegible]

the side of an incandescent one
and no difference seen in the
light. Does not seem [illegible]
The melting point [illegible]
[illegible] and some obtained higher heat
The wire appears glowing
very [illegible]
with [illegible] Nitrous oxid

Ex. No. 19 Acetylene [illegible]
[illegible] form [illegible]
slowly, when the [illegible]
held just visible, [illegible]
from burning with [illegible]
Gives more light than [illegible]
does not because fine particles
require less heat [illegible]
them to incandescence [illegible]
the same way that [illegible]

[illegible] wire becomes polished by
the melting of the fine
[illegible] the surface
[illegible] the [illegible] of the tent of
the main wire which may
[illegible]. Hence [illegible]
[illegible] water
[illegible]
[illegible]
[illegible]

Feby 12 1899

Ex. No. 20 Acetate of Ammonia does not corrode the wire at any heat.

July 12 1879

Ex. No. 21 Acetate of Lime gives a very fine [illegible] seemingly continuous [illegible] cross [illegible]; I need [illegible] microscope [illegible] to be [illegible] with the Ex. [illegible] are [illegible] appearance.

Ex. No. 22. N salts have no effect other than the air when Pt. Spiral is heated in it and also in vacuum

~~Ex. No. 23.~~

Ex. No. 23. Dried Alcohol vapor could see no change

Ex. No. 24 filled globe with Tobacco smoke & watch the air connection.

Ex. No. 25 Put a piece of paper in contact with the original so that it would burn [illegible] good connection

Ex. No. 26 Ammonia and H2S fried moistened paper and needle and put on the [illegible] good result.

Ex. No. 27 Spiral coated with Acetate of magnesia in vacuum. Current put on at 3.30 P.M. Very brilliant incandescence. Vacuum loses some weight after about an hours running when it went to sleep. Spiral left in open air.

The tip of the glass bulb [illegible] and the wires [illegible] at [illegible] with a bright precipitate [illegible] being ~~the~~ in the air for some time. No ~~trace~~ image [illegible] turn to be seen.

[illegible] about [illegible] which [illegible].

Spiral covered with lime

Ex. No. 28

8-30 P.M. Same spiral 157

12 1899

white 10-3

[illegible]

[illegible]

In the air for [illegible] hours

A thin black deposit noticed

which the filtrate remained [illegible]

as that none was [illegible]

directly behind the [illegible]

The wire was [illegible]

inside of the [illegible]

as the deposit was very much

less it is hoped [illegible]

completely covering the [illegible] It was

[illegible] removed [illegible]

Fol. 131878

Ex. No. 28 The coating under the microscope [illegible]

Ex. No. 29. [illegible] and no good [illegible]

Ex. No. 30. [illegible] dissolved with [illegible] lime, magnesia,

Ex. No. 31 Instead of [illegible] not dissolved easily

32 Nitbiume melts [illegible] attacks it furiously.

33 Glass tried and a good coating obtained

Album Nly. Glycerine [illegible]

Protochloride of tin [illegible] sticks

Proposed to [illegible] through a bath of [illegible] of tartaric [illegible] oxalate of magnesia [illegible] but [illegible] must be infinitible

Carbonate Magnesia does not [illegible]
alcohol when [illegible] with [illegible]

Good covering when the [illegible]
white hot. When continued at
white heat in the [illegible]
Turns gray & crack.
Lime combines.
Valuable [illegible] of Magnesia [illegible]
the [illegible] heat [illegible]
off [illegible]
[illegible] Tube [illegible]

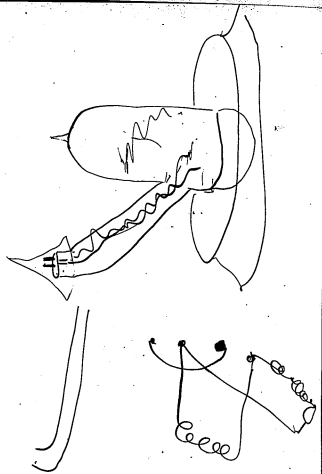
Ex. No. 34 Iron by H [illegible]
temper [illegible]

Ex. No. 35 Asphalum [illegible]
with magnesia [illegible]
[illegible]

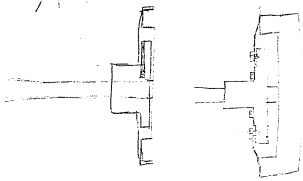
Ex. No. 36. Feby 13 1879

The Edison dynamo machine

When first tried [illegible]
partly taste with [illegible]
By turning the [illegible]
fine sparks were [illegible]
a foot and a half [illegible]
twice was [illegible]
hot with [illegible]
[illegible] of the
commutator [illegible]
Tried the [illegible]
current [illegible]
a perfect [illegible]
[illegible]
for [illegible]
as were from the [illegible] engine



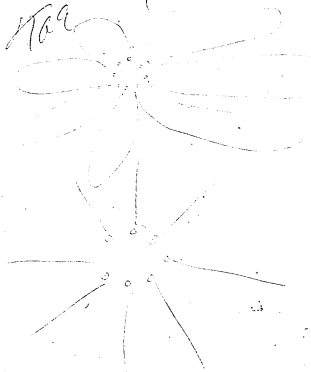
Feb. 14, 1879.



The [illegible]

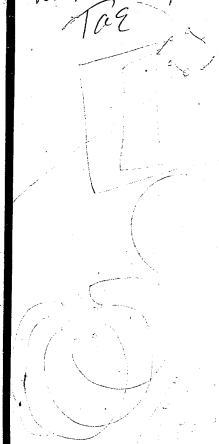
Feb 14 1879

Tag



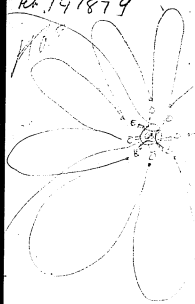
Feb. 14 1879

Tag



Feb 14 1879

Feb 14 1879



Feb. 14. 1879 Hrlyton. 135

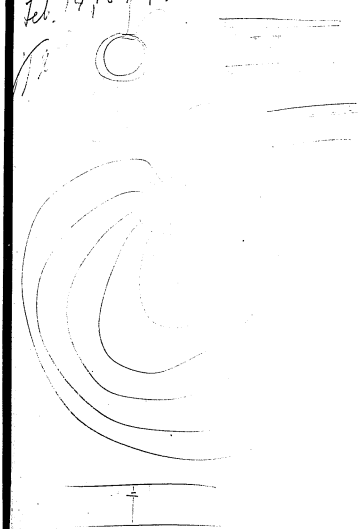
Note.

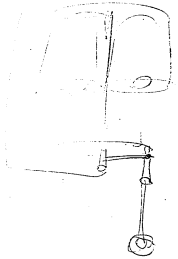
Feb 14 1879

Feb. 14, 1879.

121

Feb. 14, 1879.



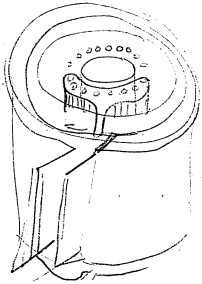


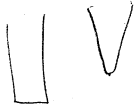
Feb 19, 1879

(31)

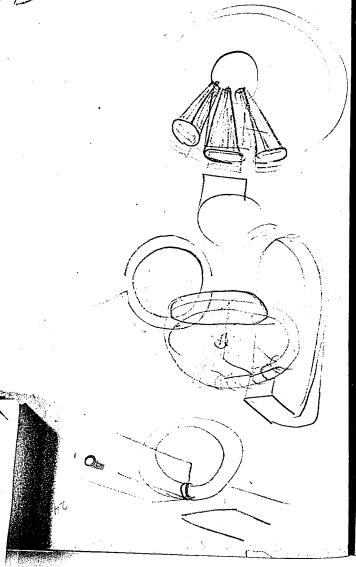
Fig 21

Christmas Current machine





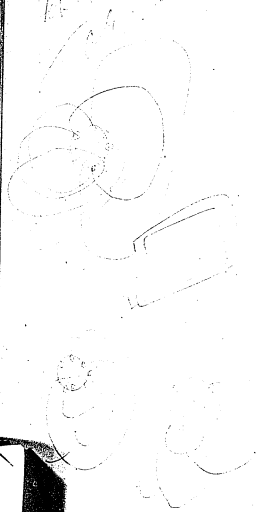
(32)



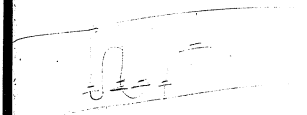
Feb. 14th 1879.

Diagram 1a

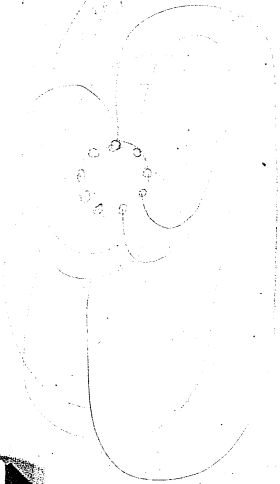
To utilize a current [illegible] the connector and handle [illegible] spark from [illegible]

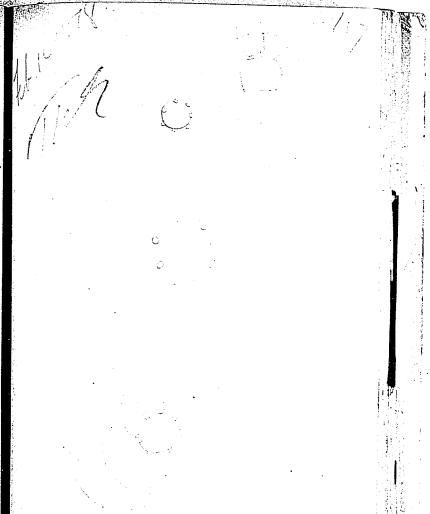


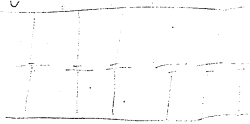
Ex No. 3 T. Iron and Pt wire sealed in glass tubes. No special result.

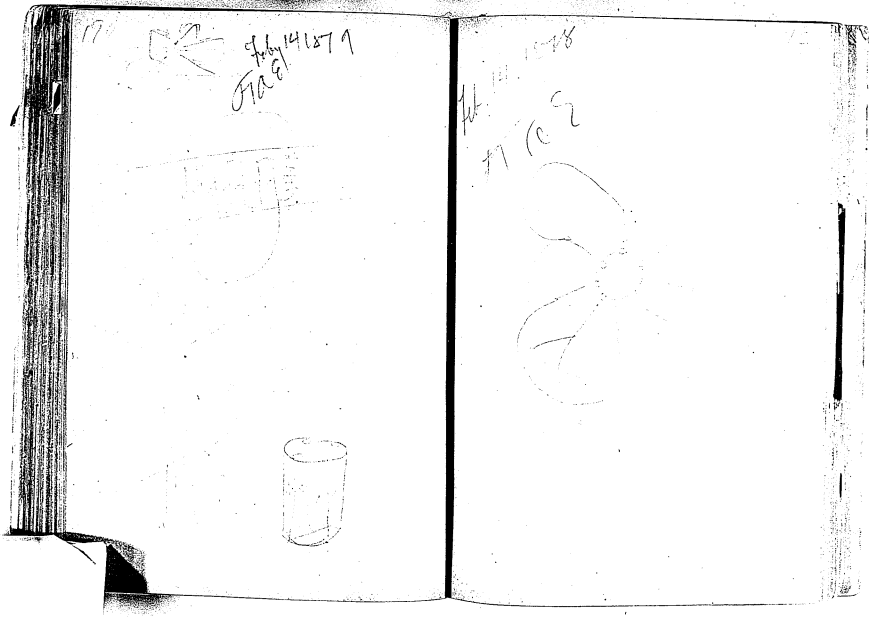


156
Feb 14 1879









Sept. 14 1876

Sept. 14 1876

194

Vi. No. 33. Page Feby 14 1694 19

Acetate of Ammonia may be
crystallized

Chloride of ~~Lime~~ ammonia
good crystals [illegible]

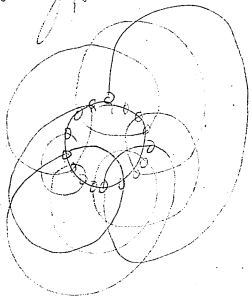
Show the [illegible]

The mixture [illegible]
Chloride of K+

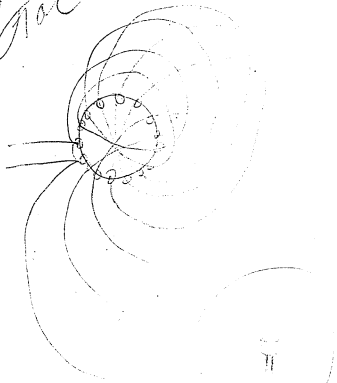
Exp. on hydrogen

See Book 4 pp 77-

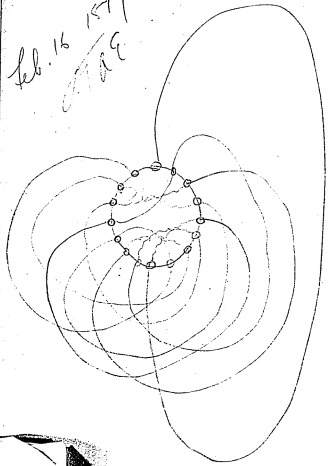
Jd. 16.1579



Jd. 16.1579



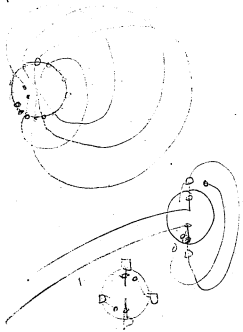
feb. 16 1879



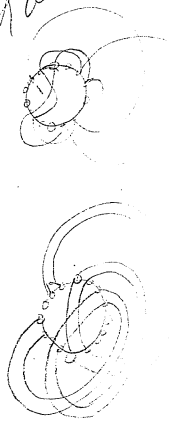
feb. 15, 1879

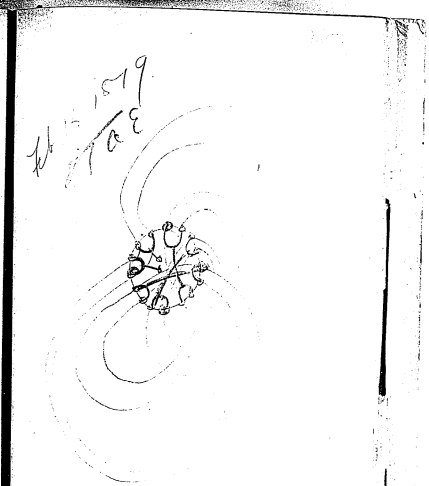
200

Feb 16 1879

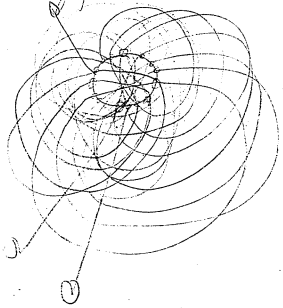


Feb 16 1879

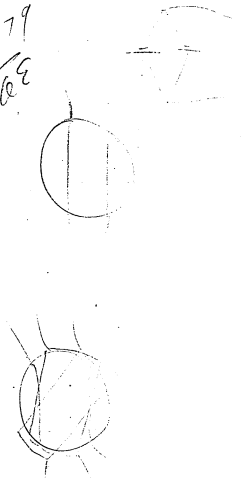




Feb 16 1979



Feb 16 1979



3 ·040

640

1000

·041

·32

51

54

5·50

3·14

3·50

15·70

15·70

·32 | 16·00

12·56

54·00

54·00

54

·32

108

162

17·28

42

·04

·16

·32

54

12

160

17·28

5

42

12 | 502

42

$\frac{1}{3}$ ohm

118 = 1 : 2

118 | 420 | 3·5

354

660

42

17 | 336

28

54 units

118 | 28·0 | ·25

236

·440

90

·51 / 16·28

·16 ·40

17·28

16·28
14·07
·54

1

25

26

54 coils of 4 turns of 20 wire take up 17·28 inch diam of shell.

each coil ·16 both sides ·32

Diameter × ·3141 17·28 [illegible]

Feathers 4 ¼" [illegible]

available space for Coils

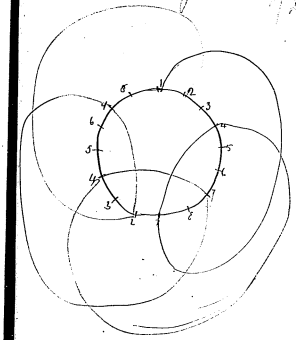
16·28 each ·32 = 51 coils

will 51 coils do.

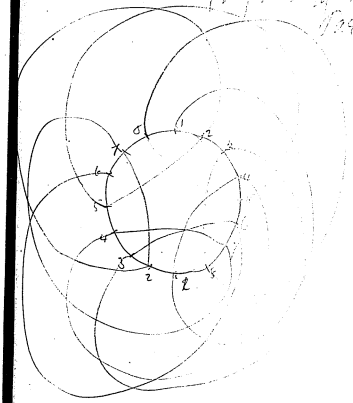
[illegible]

210

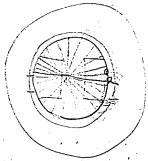
Feby 10 1892



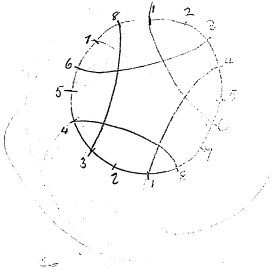
212



Feby 16 1874
Jal

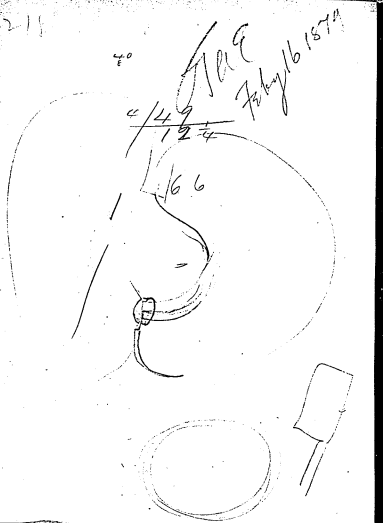


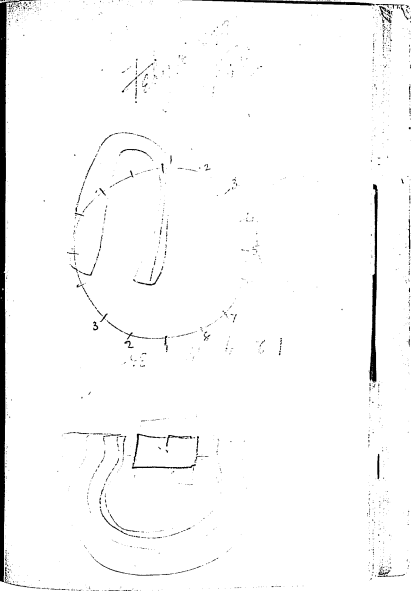
Feby 16 1874



July 16 1879
No

July 16 1879
No





Mr. Magnetic — Tall

Mark of wire [illegible] = [illegible] × 142

[illegible] diameter [illegible]

[illegible] to lay [illegible]

[illegible] 7 – 4 [illegible] – last [illegible]

[illegible] division of [illegible]

[illegible] 21

Still outside = [illegible]

divide with [illegible]

1st division [illegible]

[illegible] 21 width [illegible]

Lay 1 strip of [illegible]

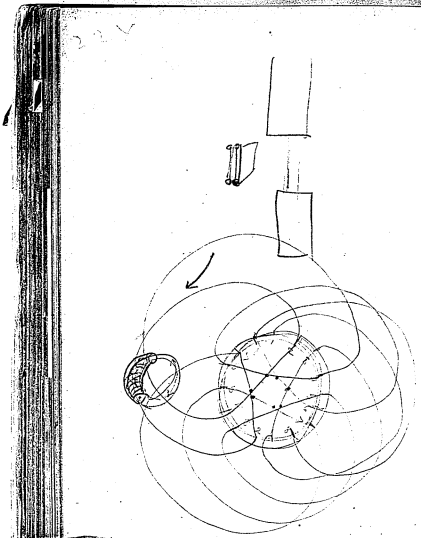
[illegible] and gross = [illegible]

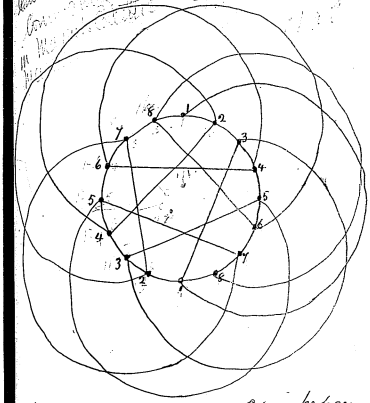
division = [illegible]

Will use 8 in [illegible]

4, fill side

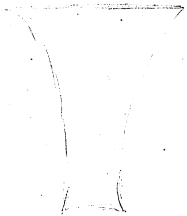
Feby 20 1579
Feby 20

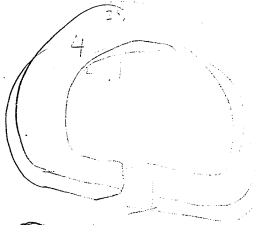


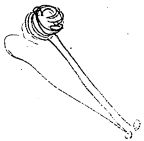


Two ends left open 1. 7 8. Edison proposes
to fasten these two ends to two small commu-
tators as:-

326







228 Diam .005 in.

.005 in Pt. ~~Brown~~ Sharp ~~.005~~ 5¾

600 mm. R = 8.7 Ohms

Diam .005 in. ~~B.&S~~ ~~.005~~

10% Pt. Iridium

~~B~~ 600 mm. R = 17.4 Ohms

20% Pt. Iridium

Diameter .005 B.&S.

600 mm. R = 15.4 Ohms

Feb 29 1899 JWR

Iron wire .015 + B&S

60 mm. R = .62 Ohms

Iron wire .011½ B. & S

60 mm. R = .89 Ohms

○ Primary .17 Ohms

Secondary 58 Ohms

□ Primary .41 Ohms

Secondary 142 Ohms

575²

500

6.7 Ohms

500² : 575² :: 6.7 : 89

575
575
2875
4025
2875
3306 25

89
15
445
89
1335
810

62
9
558
71

3306
25)

3306
4
13216

1.32
67
924
792
8.844

6.4 Ohms
8.8 Ohms

30.
6
180

27 feet 1.011 miles

4
108.
25
540
25

5.58
15
2790
558
40
837

216
2700
24
30
25
5

(675)

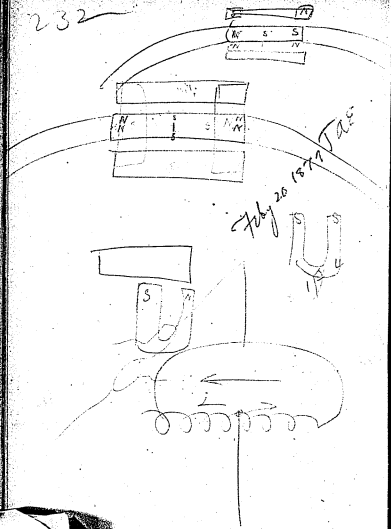
17
3

27. .6.

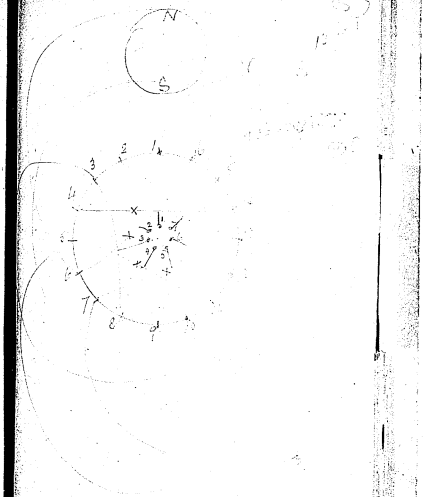
6 27

7

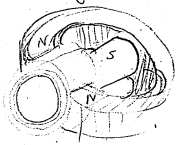
232

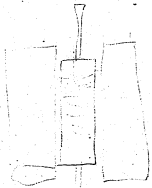


July 20 1877



Feb 20 1879 Tar





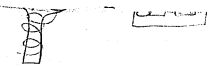
Feb 20 1879 Tar

Edison Laboratory Note Book No. 14.

Page 235.

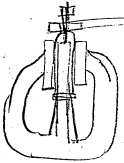
See Edison Patent:

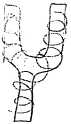
370,128 (Pat. Sept. 21, 1887.)

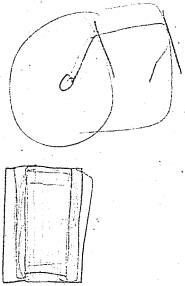


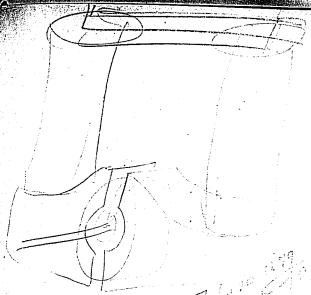
Febyzo 1879 Tal

Febyzo 1879 Tal









240

4½. Gunt.

$\frac{4\frac{1}{2}}{25}$ $\frac{1}{50}$

100 100

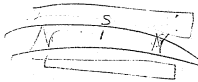
17.

4½ : 3 : 25 : ans

4.5) 75 (17.
45
300

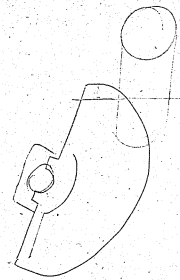
15

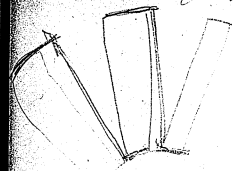
100 25

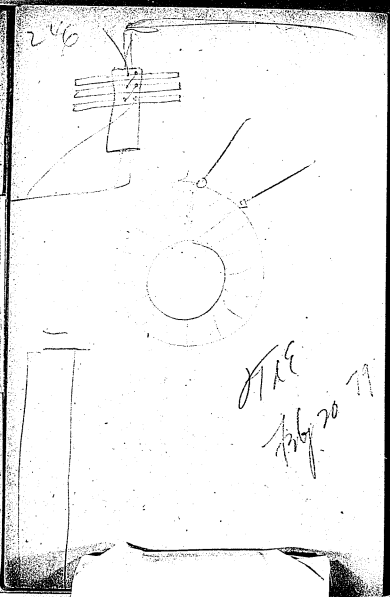


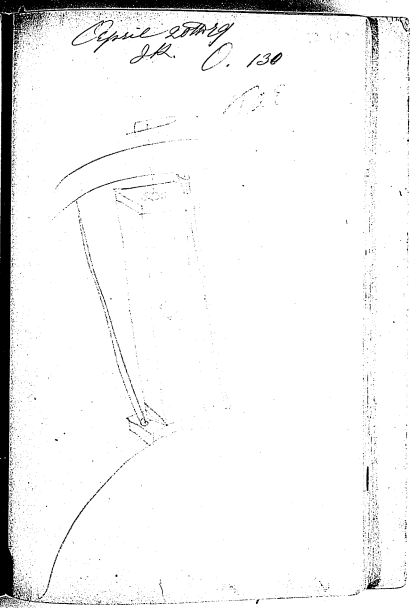
17
100

2500.
2000.



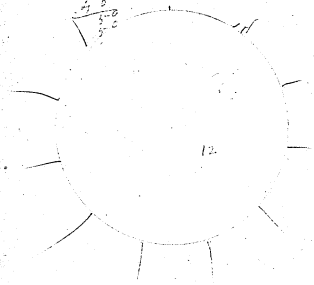






11) 3 3/12 10.

10) 375-00 (375.
30
75
70
50
50



Op. 20.00 O. 130
J.H.
bars 3 1/2 Pay is

12 bars

38
2
76
3
228
45
1140
912
12) 10260 = 855
118) 855 = 7
40

152) 19.26 .126
406
1020
912
3

99) 1995 = 20
198
15 4
63

228
63
684
3) 1436 4 = 1194 = 10.
116
84

38
12
76
38
456
23
1368
2280
12) 24168 = 2014
4

253) 7266
506
126

38
9
342
90
12) 23940 .1995
119
114
60

3) 232.47

45
4
180) 19268
126
53

104

180

170) 2014 = 12.
114
240
1440
9

58
38
464
174
2204
9
13) 13836 = 1653 ft

232) 1653 = 7.12 Ans
1684
290
3) 405 136
270

210 1653
1680
1830
7
58
13) 15 = 13
180

90) 19.26 (.2140
180
26
360
.214
76
.164

31
38
12
76
38
456
24
4104
1824
2234
114
94

31) 164
124
40

1926
120
110) 19.060 (.173
60.5
360
90) 1206 = 174
726
686
400

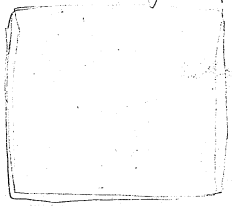
1862 = 24.82
150
362
620
200

1862 = 24.82

450
92

450
6
2700

9 / 54000, 600



600
9
5400

4

120,

33

weight – 275 lb.

diameter

1500 [illegible]

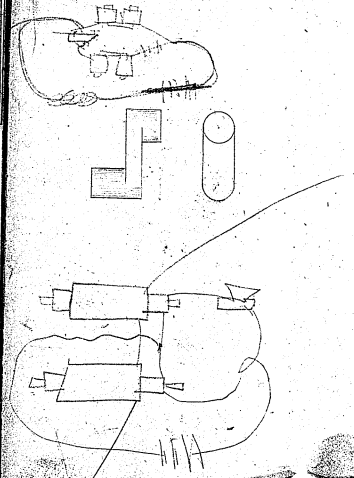
18.000

10
400

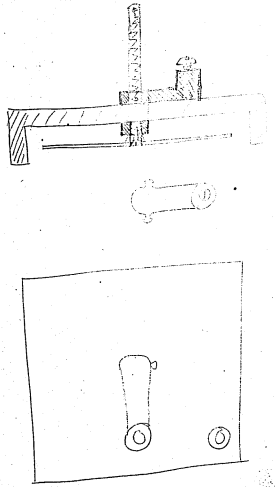
5

20.

3



Cool. tap for ATR.



2 1/8.

$\frac{1}{3}$

b = conductance

Let a = orig lamp

$\frac{a}{n}$ = multiple

$\frac{1}{a+b}$ = orig current

$\frac{1}{\frac{a}{n}+b}$ = multiple current

$\frac{\frac{1}{n}}{\frac{a}{n}+b}$ = current in each lamp

$\frac{1997}{998}$

$\frac{2000}{2001}$ .999

$\frac{1333}{1334}$

$\frac{1000}{1001}$

$\frac{800}{801}$

666.66
667.66

571.4
572.4

500
501

444.44
445.44

10 lamps

400
401

6021
6031 .997
.9990
.9980 .9955

15 lamps 4000

~~263.6~~
~~264.6~~

266.66
267.66 ~~.9955~~

.992 ~~.9955~~

~~234.33~~

20 lamps

200
201

21
.9979
.9958

.990

25 lamps

169
167

27
.9973
.9946

.987

262

32 lamps

125
126

35
.9965
2
.9930

.984

70 lamps

100
101

43
.9957
2
.9914

.980

20 | 1965
.982 Table

200 lamps

20
21

.3010
.3222
.9788
2
.9576

.907

1814
907 Table

400

10
11

0414
9586
2
.9172

.826

1656
828

4
5

6021
6990
.9031
2
.8062

1000

800

640

1280
640 Table

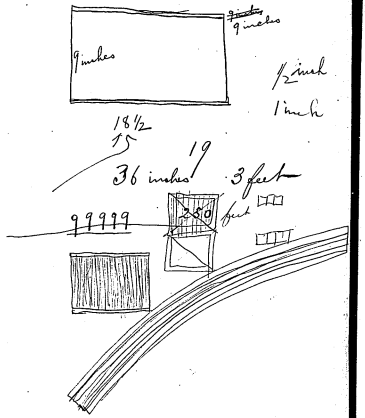
1000

2
3

3010
4771
.8239
2
.6478

.444

888
444



(6)

3.15
85
1575
2520
26.775

.250
.200

.200) 26.775 (3387
134
87

67. commutator turnions .200 for wire

67
3
201 feet around one wire continuously

$\frac{170.6}{(.042)^2} = \frac{20.1}{x^2}$

1/4 ft

.045

20.1 — 2.3032
42 — 2.6232
42 — 2.6232
comp 170.6 — 7.7681
1.3177
2.65588

.045

266

4 ⟌ 250
62.5
3
187.5

Core 8 3/4
8 3/4

26.77 1.4276
.187 $\bar{1}.2718$
2.1558

143
71
3
213 feet

62.5
12.5
50

241.9 : 213 :: 25
25

213 2.3284
25 1.3979
241.9 7.6151
1.3414

21.9
.219 Ohms one turn

219
4
3 ⟌ 876
.292 Ohms

.049 75 commutator

8.75 9.25 9.5
9.5
1875
2
12 ⟌ 3750 inches
3125 feet

8.75 .9420 9.
3.16 .4997
27.67 1.4417

Make core

9 inches

62.5
2 | 2.75
1.375

1 3/8 inches iron

3.16
9
28.44

4 | 260
65
65
12
53

65
3
.195

covers

28.44 1.4539
.195 1.2900
2.1639

2 | 145.8
73.

18
18.5
| 136.5
3.04
73
912
2129
221.9 2 feet

2 41.9 : X :: 50² : 53²

241.92 3836
53 1.7243
53 1.7243
comp × 5 = 6.6021
2.4343

2.3836
6.6021
8.9857 -10

272 feet

272 : 221.92 :: 25 :

2.3462
1.3979
7.5654
1.3095

20.3
4
| 8.2
.26.4 Ohms

.264 Ohms

73 coils wound 4 layers

wire .1053 in. in diameter wound in in three

1268

67

12 covering

55

67
3
201

28.44 1.4537
2.07 .3160
1.1377

1137
68 Coils

3.04
68
2432
1824
206.72

8.98 57
55 1.7404
1.7404
2.6765 ~~777~~ feet
299 feet

299 : 206.7 :: 25

2.3154
9.3979 -10
7.5235 -10
1.2368

172
4
3 | 728
243 Ohms

Machine wound
67 coils .055 wire
allowing .012 for covering
four layers of three wires
connected gives .243 Ohms
The thickness of wire
on armature .268 in.

68
4
272 turns

39
12
78
39
468 turns on No. 1½

75 commutators

.049
.013
.062
3
.186

2)379
.189

75 Commutators

75)2844 (3.79
225
594
525
690

167

47
13
34

304
75
1520
2128
228.00 feet on Machine

230 feet in

75 Commutators
No. 18 Wire

62
3
.186
.189
.376

Distance from .3
Iron core to Face Armature

75
3
225 machine No. 4

702 Machine No. 182

702
225) 702 (3.1
625
270

1/3 the No. of turns

.625
.468

.7959
.6702
.1257
.1464
.2718

.1257
.0414
.1671

147 Volts

.625 7
.468
140

216

.035 wire No. 20

118.5 feet 1/4 ohm on machine

228 feet

228
118.5
11923

2.3579
2.0736
2847

4 | 189
47.25
35
1.25

.481 ohms on machine
.12 ohms one layer
4 wires side by side
2 layers
.24 ohm resistance

.035
47
2
.094

75
2
150 turns

.094
.010
.040
.144
.047

144)468 (3.2
432
360
288
720

150)468 (3.1
450
180

47 ft)28440 (605
282
240

1500
225
33000
300

2/8

35
13
.48
.48
.96
.60
1.56

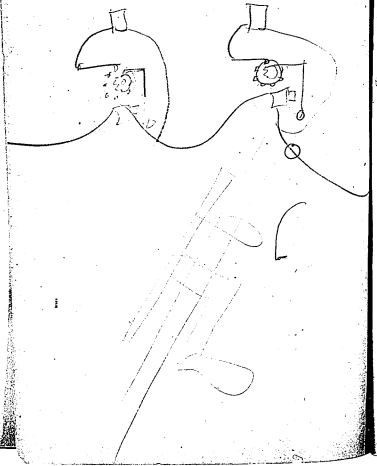
20
10
30

1/8 .125
1/32 .03125
1/64 .01562

.035
.013
.020
.010

286

May 25 1879



287

48 : 12 = 4 :

148
148
1904
592.
148
21924

14108552
14144448
9885064
4250496
11334656.
8504992.
1416832.
5664328.
1416832.
1986112,916224